REMARKS

Applicants respectfully request reconsideration in view of the foregoing amendments and following remarks.

Claims 1-38 are pending. In the Office action dated November 27, 2001, claims 1-6, 9-20, 22-24, and 26 were rejected as being unpatentable over U.S. Patent No. 5,835,149 to Astle ["Astle"]. Claims 7, 8, and 21 were objected to as being dependent upon a rejected base claim, but otherwise allowable. Claim 25 was allowed.

Applicants respectfully add claims 27-38.

1) Applicants have rewritten claim 21 in independent form as claim 27.

Applicants have rewritten "objected to" claim 21 in independent form as claim 27, incorporating the language of claims 15 and 19.

Claim 27 should be allowable.

2) Based upon the statement of reasons for allowable subject matter, it appears claim 26 should have been allowed.

The Office action dated November 27, 2001 allowed claim 25 and provided a statement of reasons for allowable subject matter:

> [T]he prior art fails to teach or define singly or in combination the claimed limitation of "prioritizing encoded data units for transmission such that they are transmitted with highest priority, remotely predicted units are sent with the next highest priority, and the predicted units are transmitted with lowest priority" as in claim 25. [Office action dated November 27, 2001, paragraph 4.]

Claim 25 does not include the language "prioritizing," "priority," or "transmission." Instead, the quoted statement seems to apply to claim 26, and claim 26 should have been allowed.

Applicants believe claim 25 should also be allowable, but respectfully request clarification as to the status of claim 25.

3) Applicants respectfully request the Examiner provide an initialed copy of page one of the Form 1449 for the IDS filed April 7, 2000 by Applicants in the present application.

Applicants filed an Information Disclosure Statement on April 7, 2000 in the present application, along with a two-page Form 1449. With the Office action dated November 27, 2001,

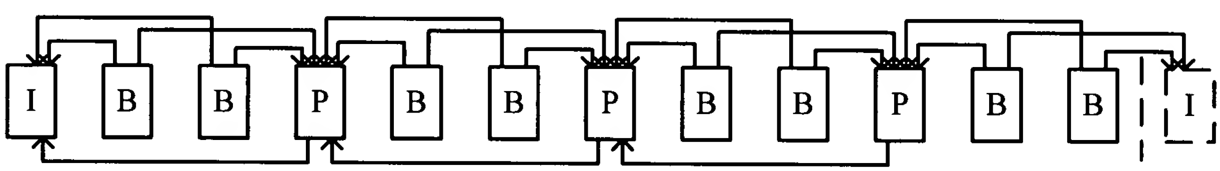
Applicants received an initialed copy of the second page of the Form 1449. Applicants have not received an initialed copy of the first page of the Form 1449, which lists 22 U.S. patent references.

Applicants respectfully request the Examiner provide an initialed copy of the first page of the Form 1449 for the April 7, 2000 IDS. If requested by the Examiner, Applicants will provide copies of the IDS, Form 1449, postcard showing receipt by the U.S. P.T.O., or references cited in the IDS.

4) With the goal of reaching a shared understanding of the scope of Astle, Applicants respectfully make the following observations.

Astle describes encoding and decoding video pictures of a sequence using motion estimation. [*See* Astle, 8:13-17, 9:6-9.] The encoded pictures can include intra-pictures ["I pictures"], predicted pictures ["P pictures"], and bi-directional pictures ["B pictures"], as utilized in coding standards such as MPEG-1. [*See* Astle, 8:61-63.] For reference purposes, Applicants provide a copy of the MPEG-1 coding standard. [*See* ISO/IEC 11172-2, Information Technology -- Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s -- Part 2: Video.] Various parts of Astle describe encoding B and P pictures, including 8:38-57 and 14:64-15:19. Various pages of the MPEG-1 coding standard relate to encoding B and P pictures, including pages 54-57 and 79.

I pictures and P pictures are reference pictures. A P picture is predicted from the previous "reference picture" in a sequence. The arrows at the bottom of the following graphic show the dependency relationships (i.e., which pictures are predicted from which other pictures) for P pictures in the example display sequence IBBPBBPBBPBB, ...:



[*See* Astle, 17:5-23, 8:38-63, 9:6-9; *see also* MPEG-1 coding standard, pages 54-57 and 79.] Each B picture is predicted from a previous and/or a following reference picture. [*See* Astle, 8:54-57.] The arrows at the top of the graphic show the dependency relationships for B pictures in the sequence.

Prediction is rarely perfect, and can result in error for a predicted picture. As a series of pictures is predicted from previously predicted pictures, error can accumulate. Periodically, new I pictures are sent, "for otherwise cumulative errors may build up in the successively compressed and

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reconstructed pictures." [Astle, 9:43-45.] Moreover, new I pictures can be sent at scene changes. [*See* Astle, 9:45-50.]

Much of Astle is devoted to describing how to adjust quantization levels for different types of pictures, so as to allocate bits between different types of pictures and control bitrate. [*See, e.g.*, Astle, 4:42-67, 10:25-44, 15:29-64, 16:59-63.] In other words, Astle emphasizes optimizing quality for a given bitrate.

5) Claims 1-24 should be allowable.

Astle fails to teach or suggest at least one limitation of each of claims 1-24. Therefore, claims 1-24 should be allowable.

a) Claims 1-11

Claim 1, as amended, recites:

> encoding at least one predicted unit in the segment relative to one of plural remotely predicted units in the segment; and
> encoding each of the plural remotely predicted units in the segment relative to the independent unit in the segment to thereby decrease susceptibility to loss in the plural remotely predicted units in the segment.

According to amended claim 1, a segment of data units is encoded. At least one predicted unit in the segment is encoded relative to a remotely predicted unit. Each of plural remotely predicted units in the segment is encoded relative to an independent unit in the segment. This can result in less efficient compression of a remotely predicted unit when the independent unit is farther away in the segment (and likely worse for prediction) than a previous remotely predicted unit. Encoding multiple remotely predicted units from the independent unit, however, decreases "susceptibility to loss in the plural remotely predicted units in the segment," as recited in claim 1. [*See, e.g.*, Application, pages 3 and 4.] For example, the segment could be IPPRPPRPPRPP, where I represents an independent unit, each P represents a predicted unit, and each R represents a remotely predicted unit. Each R is encoded relative to I. Encoding the third R relative to I can be less efficient than coding it relative to the second R, but the third R is no longer susceptible to loss in the second R.

Astle does not teach or suggest the above-cited language of claim 1. As discussed above in paragraph 4, Astle describes encoding with I pictures, B pictures, and P pictures. The I pictures and

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P pictures are reference pictures. [*See* Astle, 8:45-48.] A B picture is predicted from a previous and/or a following reference picture. [*See* Astle, 8:54-57.] A P picture is predicted from the previous reference picture. [*See* Astle, 8:38-63, 9:6-9, 9:43-45; 17:5-23.]

In the Office action of November 27, 2001, the Examiner's position seems to be that the P pictures of Astle correspond to the "predicted units" of claim 1, and the B pictures of Astle correspond to "remotely predicted units" of claim 1. [*See* Office action of November 27, 2001, paragraph 3.]. If, for the sake of argument, one adopts the Examiner's position, Astle still does not teach or suggest the above-cited language of claim 1. Claim 1, as amended, recites, "encoding at least one predicted unit in the segment relative to one of plural remotely predicted units in the segment." In Astle, however, B pictures are not reference pictures [*see* Astle, 8:49-51], and no P picture is encoded relative to a B picture.

A second position with respect to Astle would be that the B and P pictures of Astle correspond to the "predicted" and "remotely predicted units" of claim 1, respectively. If, for the sake of argument, one adopts this second position, Astle still does not teach or suggest the above-cited language of claim 1. Claim 1, as amended, recites, "encoding each of the plural remotely predicted units in the segment relative to the independent unit in the segment to thereby decrease susceptibility to loss in the plural remotely predicted units in the segment." In Astle, however, a P picture is predicted from the previous reference picture [*see* Astle, 8:38-63, 9:6-9, 9:43-45; 17:5-23], and multiple P pictures in a segment are not each encoded relative to an I picture in the segment to decrease susceptibility to loss in the multiple P pictures in the segment.

Furthermore, Astle leads away from the above-cited language of claim 1. Astle emphasizes optimizing quality for a given bitrate. [*See, e.g.*, Astle, 4:42-67, 10:25-44, 15:29-64, 16:59-63.] Encoding multiple remotely predicted units in a segment relative to an independent unit in the segment can result in less efficient compression of a remotely predicted unit, for example, when the independent unit is farther away in the segment (and likely worse for prediction) than a previous remotely predicted unit. Astle's emphasis on quality/bitrate leads away from "encoding each of the plural remotely predicted units in the segment relative to the independent unit in the segment to thereby decrease susceptibility to loss in the plural remotely predicted units in the segment," as recited in claim 1.

Astle does not teach or suggest the above-cited language of claim 1. Claim 1 and dependent claims 2-11 should be allowable. In view of the foregoing discussion of claim 1, the merits of the separate patentability of claims 2-11 are not belabored at this time.

b) Claims 12-14

Claim 12, as amended, recites:

> decoding each of plural remotely predicted units in the segment relative to the decoded independent unit in the segment; and
> decoding at least one predicted unit in the segment relative to a decoded one of the plural remotely predicted units in the segment.

Astle does not teach or suggest the above-cited language of claim 12. Astle describes encoding and decoding with I pictures, B pictures, and P pictures. The I pictures and P pictures are reference pictures. [*See* Astle, 8:45-48.] A B picture is predicted from a previous and/or a following reference picture. [*See* Astle, 8:54-57.] A P picture is predicted from the previous reference picture. [*See* Astle, 8:38-63, 9:6-9, 9:43-45; 17:5-23.]

In the Office action of November 27, 2001, the Examiner's position seems to be that the P pictures of Astle correspond to the "predicted units" of claim 12, and the B pictures of Astle correspond to "remotely predicted units" of claim 12. [*See* Office action of November 27, 2001, paragraph 3.]. If, for the sake of argument, one adopts the Examiner's position, Astle still does not teach or suggest the above-cited language of claim 12. Claim 12, as amended, recites, "decoding at least one predicted unit in the segment relative to a decoded one of the plural remotely predicted units in the segment." In Astle, however, B pictures are not reference pictures [*see* Astle, 8:49-51], and no P picture is decoded relative to a B picture.

A second position with respect to Astle would be that the B and P pictures of Astle correspond to the "predicted" and "remotely predicted units" of claim 12, respectively. If, for the sake of argument, one adopts this second position, Astle still does not teach or suggest the above-cited language of claim 12. Claim 12, as amended, recites, " decoding each of plural remotely predicted units in the segment relative to the decoded independent unit in the segment." In Astle, however, a P picture is predicted from the previous reference picture [s*ee* Astle, 8:38-63, 9:6-9, 9:43-45; 17:5-23], and multiple P pictures in a segment are not each decoded relative to an I picture in the segment.

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Furthermore, Astle leads away from the above-cited language of claim 12. Astle emphasizes optimizing quality for a given bitrate. [*See*, *e.g.*, Astle, 4:42-67, 10:25-44, 15:29-64, 16:59-63.] Encoding multiple remotely predicted units in a segment relative to an independent unit in the segment can result in less efficient compression of a remotely predicted unit, for example, when the independent unit is farther away in the segment (and likely worse for prediction) than a previous remotely predicted unit. Astle's emphasis on quality/bitrate leads away from "decoding each of plural remotely predicted units in the segment relative to the decoded independent unit in the segment," as recited in claim 12.

Astle does not teach or suggest the above-cited language of claim 12. Claim 12 and dependent claims 13 and 14 should be allowable. In view of the foregoing discussion of claim 12, the merits of the separate patentability of claims 13 and 14 are not belabored at this time.

c) Claims 15-24

Claim 15, as amended, recites:

> wherein at least one data unit classified as a predicted unit is designated to be predicted from an adjacent remotely predicted unit in the series; and
> wherein each of plural data units classified as remotely predicted units in a particular segment is designated to be predicted from a single independent unit in the particular segment to thereby decrease susceptibility to loss in the remotely predicted units in the particular segment.

Astle does not teach or suggest the above-cited language of claim 15. As discussed above in paragraph 4, Astle describes encoding with I pictures, B pictures, and P pictures. The I pictures and P pictures are reference pictures. [*See* Astle, 8:45-48.] A B picture is predicted from a previous and/or a following reference picture. [*See* Astle, 8:54-57.] A P picture is predicted from the previous reference picture. [*See* Astle, 8:38-63, 9:6-9, 9:43-45; 17:5-23.]

In the Office action of November 27, 2001, the Examiner's position seems to be that the P pictures of Astle correspond to the "predicted units" of claim 1, and the B pictures of Astle correspond to "remotely predicted units" of claim 1. [*See* Office action of November 27, 2001, paragraph 3.]. If, for the sake of argument, one adopts the Examiner's position, Astle still does not teach or suggest the above-cited language of claim 15. Claim 15, as amended, recites, "at least one data unit classified as a predicted unit is designated to be predicted from an adjacent remotely predicted unit in the series." In Astle, however, B pictures are not reference pictures [*see* Astle, 8:49-51], and no P picture is encoded relative to a B picture.

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A second position with respect to Astle would be that the B and P pictures of Astle correspond to the "predicted" and "remotely predicted units" of claim 15, respectively. If, for the sake of argument, one adopts this second position, Astle still does not teach or suggest the above-cited language of claim 15. Claim 15, as amended, recites, "each of plural data units classified as remotely predicted units in a particular segment is designated to be predicted from a single independent unit in the particular segment to thereby decrease susceptibility to loss in the remotely predicted units in the particular segment." In Astle, however, a P picture is predicted from the previous reference picture [*see* Astle, 8:38-63, 9:6-9, 9:43-45; 17:5-23], and multiple P pictures in a segment are not each predicted from a single I picture in the segment to decrease susceptibility to loss in the multiple P pictures in the segment.

Furthermore, Astle leads away from the above-cited language of claim 15. Astle emphasizes optimizing quality for a given bitrate. [*See*, *e.g.*, Astle, 4:42-67, 10:25-44, 15:29-64, 16:59-63.] Encoding multiple remotely predicted units in a segment relative to a single independent unit in the segment can result in less efficient compression of a remotely predicted unit, for example, when the independent unit is farther away in the segment (and likely worse for prediction) than a previous remotely predicted unit. Astle's emphasis on quality/bitrate leads away from "each of plural data units classified as remotely predicted units in a particular segment is designated to be predicted from a single independent unit in the particular segment to thereby decrease susceptibility to loss in the remotely predicted units in the particular segment," as recited in claim 15.

Thus, Astle does not teach or suggest the above-cited language of claim 15. Claim 15 and dependent claims 16-24 should be allowable. In view of the foregoing discussion of claim 15, the merits of the separate patentability of claims 16-24 are not belabored at this time.

6) Applicants respectfully add claims 27-38.

Applicants respectfully add claims 27-38.

Claim 27 is discussed in paragraph 1, above.

Claim 28 recites language similar to the language stated by the Examiner in the statement of reasons for allowable subject matter for claim 25. [*See* Office action dated November 27, 2001, paragraph 4.] Claims 28-31 are directed to processing a segment of plural video frames, including prioritizing "encoded video frames for transmission such that independent frames are transmitted

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with highest priority, remotely predicted frames are transmitted with next highest priority, and predicted frames are transmitted with lowest priority." [*See*, *e.g.*, Application, pages 24-25.]

Claim 32 is directed to encoding a group of plural video frames, wherein each remotely predicted frame is encoded by inter-frame coding relative to a buffered independent frame. [*See*, *e.g.*, Application, pages 7-8.] Claim 33 is directed to decoding a group of plural video frames, wherein each remotely predicted frame is decoded by inter-frame decoding relative to a buffered independent frame. [*See*, *e.g.*, Application, pages 7-8.]

Claims 34-38 are directed to processing a segment of plural video frames, including "varying a remotely predicted frame spacing to balance bitrate of the segment against loss recovery capability for the segment." [*See*, *e.g.*, Application, pages 22-23.]

CONCLUSION

The claims in their present form should now be allowable. Such action is respectfully requested.

Respectfully submitted,

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APPENDIX -- Marked-up Version of Amended Claims

1. (Amended) A method for coding streaming media comprising a series of data units, the method comprising:

classifying each of the data units in the series as one of the following types of encoded data units: an independent unit, a predicted unit, and a remotely predicted unit, such that the data units in the series are organized into **plural** segments[, and each segment has an independent data unit, two or more predicted units and at least one remotely predicted unit, wherein the independent data unit is a data recovery point and a random access point in the series of data units, and the remotely predicted unit is a data recovery point in the series of data units that is classified independently from the random access point and is coded with more efficiency than the independent data unit];

encoding a segment of the plural segments, including:

encoding **an** [each of the data units classified as an] independent [data] unit **in the segment** [in a compressed format] using only information from the [data] **independent** unit;

encoding **at least one** [each of the data units classified as a] predicted unit **in the segment relative to one of plural remotely predicted units in the segment**[in a compressed format by encoding differences between the data unit and the immediately preceding data unit in the series]; and

encoding each **of the plural** [of the data units classified as a] remotely predicted [unit in a compressed format by encoding differences between the data unit and the data unit classified as] **units in the segment relative to** the independent unit in the segment **to thereby decrease susceptibility to data loss in the remotely predicted units in the segment**.

2. (Amended) The method of claim 1 [including:

encoding the series of data units as a sequence of encoded data units comprising contiguous segments, each contiguous segment starting with an encoded independent data unit, followed by predicted units that are each dependent on the immediately preceding data unit, and including at least one remotely predicted unit inserted within a sequence of the predicted units;]

wherein the classifying [step] is performed dynamically while previously classified and encoded data units are being transmitted.

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3. (Amended) The method of claim 2 wherein the classifying [step] includes dynamically selecting a spacing of remotely predicted units [in each of the contiguous segments] as the encoded data units are being transmitted.

7. (Amended) The method of claim 1 further including;

[encoding the series of data units as a sequence of encoded data units comprising contiguous segments, each contiguous segment starting with an encoded independent data unit, followed by predicted units that are dependent on the immediately preceding data unit, and including at least one remotely predicted unit inserted in a sequence of the predicted units such that the predicted unit immediately following the remotely predicted unit is predicted from the remotely predicted unit;]

prioritizing encoded data units for transmission such that independent [data] units are transmitted with highest priority, remotely predicted units are transmitted with next highest priority, and predicted units are transmitted with lowest priority.

8. (Amended) The method of claim 7 wherein the **transmission of the prioritized encoded data units is** [series of data units is divided into portions, and the data units in each portion are prioritized such that all independent data units in a portion are to be sent first, then all of the next highest priority data units, and finally all of the predicted units,] subject to available bandwidth constraints.

11. (Amended) A computer readable medium having instructions for performing the [steps] **method** of claim 1.

12. (Amended) A method for decoding streaming media comprising a series of data units, where the data units are arranged in **plural** segments, [and each segment includes an independent data unit, two or more predicted units and at least one remotely predicted unit,] the method comprising:

decoding an encoded bit stream to identify the data units in the series for decoding as one of the following types of [coded] data units: an independent unit, a predicted unit, and a remotely predicted unit;

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[for segments of independent data units in the series, decoding each of the segments, including:] **decoding a segment of the plural segments, including:**

decoding **an** [each of the data units classified as an] independent [data] unit **in the segment** [in a compressed format] using only information from the [data] **independent** unit;

[decoding each of the data units classified as a predicted unit by decoding differences between the data unit and the immediately preceding data unit in the series, and adding the differences with an immediately preceding data unit, which has been previously reconstructed and stored; and]

decoding each of **plural** [the data units classified as a] remotely predicted **units** [unit by decoding differences between the data unit and the data unit classified as the independent unit in the segment, and adding the differences with the independent unit, which has been previously reconstructed and stored] **in the segment relative to the decoded independent unit in the segment**; and

decoding at least one predicted unit in the segment relative to a decoded one of the plural remotely predicted units in the segment.

[in an event where a predicted unit is lost, performing loss recovery with a remotely predicted unit following the lost predicted unit;

wherein the independent data unit is a data recovery point and a random access point in the series of data units, and the remotely predicted unit is a data recovery point in the series of data units that is inserted at a location that is independent from the random access point and is coded with more efficiency than the independent data unit.]

13. (Amended) A computer readable medium having instructions for performing the [steps] **method** of claim 12.

14. (Amended) The method of claim 12 wherein the remotely predicted units form a first level of remotely predicted units, the encoded bit stream includes the first and a second level of remotely predicted units, and the second level of remotely predicted units includes at least one second-level remotely predicted unit that is predicted from a remotely predicted unit in the first level; and the method includes:

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decoding the second-level remotely predicted unit [by decoding differences between the second-level remotely predicted unit and] **relative to** the remotely predicted unit in the first level.

15. (Amended) A method for classifying data units in a media stream for prediction-based coding, the method comprising:

reading an ordered sequence of data units in an input media stream;

classifying each of the data units in the series as one of the following types of encoded data units: an independent unit, a predicted unit, and a remotely predicted unit, such that the data units in the series are organized into **plural** segments;[, and each segment has an independent data unit, two or more predicted units and two or more remotely predicted units, wherein the independent data unit is a data recovery point and a random access point in the series of data units, and the remotely predicted units are data recovery points in the series of data units that are classified independently from the random access point and are located closer together in the series of data units than the independent data units]

wherein each of the data units classified as an independent [data] unit is designated to be encoded using only information from the [data] **independent** unit;

wherein [each of the data units] **at least one data unit** classified as a predicted unit is designated to be predicted from an adjacent [data] **remotely predicted** unit in the series; and

wherein each of [the] **plural** data units classified as [a] remotely predicted [unit] **units in a particular segment** is designated to be predicted from [a remote, non adjacent data unit in the series, which is either another remotely predicted unit or an] **a single** independent [data] unit **in the particular segment to thereby decrease susceptibility to loss in the remotely predicted units in the particular segment**.

16. (Amended) The method of claim 15 [wherein each segment corresponds to a segment in an ordered sequence of segments in the input media stream;

wherein each segment in the input media stream is a temporally ordered sequence of data units starting with a first data unit, and then followed by a temporally ordered sequence of data units;]

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wherein the classifying [step] classifies the first data unit in each segment as an independent [data] unit, and classifies each data unit following the first data unit in the segment as a predicted unit or a remotely predicted unit.

22. (Amended) The method of claim 15 wherein the remotely predicted units are classified based on a [parameter returned by a receiver of the data stream that plays a decoded version of the data stream, where the parameter provides a] measure of fidelity of [the] playback of the [data] **media** stream.

23. (Amended) The method of claim 15 wherein the remotely predicted units are classified such that the series includes two or more levels of remotely predicted units, with a first level of remotely predicted units in a segment that are each directly dependent on an [I] **independent** unit of the segment, **and with** at least a second level of remotely predicted units in the segment, including a second level **remotely predicted** unit that is directly dependent on a **remotely predicted** unit in the first level.

24. (Amended) A computer readable medium having instructions for performing the [steps] **method** of claim 15.